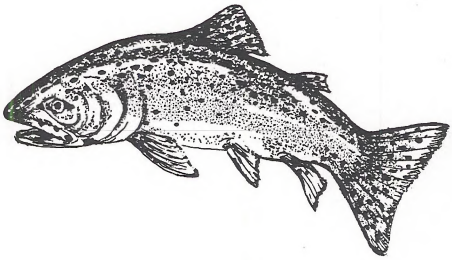
# Salmon Falls Creek Fish Inventory



by

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# SALMON FALLS CREEK FISH INVENTORY

Challenge Cost Share Project

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Idaho Department of Fish and Game

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Bureau of Land Management

**ABSTRACT**

Salmon Falls Creek fisheries and instream habitat was investigated between Lily Grade and Salmon Falls Creek Dam in 1994. This reach of Salmon Falls Creek is within a remote, narrow steep sided canyon with limited access. The source of most of the water within the stream is from springs and seepage around the dam since none is released directly from the dam itself. Water quality is good but the lack of annual flushing flows has resulted in a narrow riparian zone with dense vegetation encroaching on the stream channel and a deep build up of fine sediments in most pools. Habitat features are nearly identical at all sites investigated with numerous pools created by the presence of large boulders which have fallen into the stream from the surrounding steep canyon walls.

Fish survey results indicate a fish community dominated by numerous nongame and game fish species including smallmouth bass Micropterus dolomieui and wild rainbow trout Oncorhynchus mykiss from Lily Grade upstream with a shift to one dominated exclusively by rainbow and brook trout Salvelinus fontinalis immediately below the dam. Salmonid spawning habitat appears to be limited by the presence of large quantities of fine sediments in most sections. Bull trout S. confluentus and leatherside chub Gila copei, both species of special concern, were speculated to be present within this reach of Salmon Falls Creek but none were found in any of the surveys.

## INTRODUCTION

Salmon Falls Creek downstream of Salmon Falls Creek Dam in south central Idaho was investigated in 1994 with a Challenge Cost Share project between the Idaho Department of Fish and Game and the Boise District of the Bureau of Land Management (BLM). The project plan was to inventory and measure distribution of fish species within the reach; collect biological data from game fish species sampled; gather habitat usage and biological data on any fish species of special concern sampled; and to identify natural and manmade barriers to movement of fish within the reach.

### Study Area Description

Most of Salmon Falls Creek water originates in Nevada before flowing northward into Idaho where it is impounded by Salmon Falls Creek Dam at river mile 46, 11 km west of the town of Rogerson. Downstream of the dam, Salmon Falls Creek flows through a narrow steep sided canyon until it approaches its confluence with the Snake River between the towns of Buhl and Hagerman, Idaho. The only major tributaries to the 48 km (30 river miles) reach of Salmon Falls Creek between the dam and Balanced Rock is Cedar Creek and Devil Creek, both of which are dry during the summer due to irrigation diversions. Within this reach vehicle access is limited to crossings at Balanced Rock, Lily Grade and Salmon Dam. Foot access is extremely difficult due to the vertical walls of the canyon which varies from 80 to 90 meters deep. The reach between Salmon Falls Creek Dam and Balanced Rock is relatively unimpacted by human influences and has been considered for listing as a Wild And Scenic River with the BLM upstream of Lily Grade.

Flows within lower Salmon Falls Creek are greatly modified by the dam since its construction in 1910. Virtually all of the water is diverted into a canal bypassing the natural stream channel, except that during an emergency water may be spilled over the rim into the canyon from the canal. The only releases made into the canyon since the dam was constructed were from May 11 to June 29, 1984 and April 22-30, 1985 (Harenberg et al. 1987). Water does leak out from the reservoir into the lower canyon through crevices in the rock strata around the dam. This leakage probably amounts to less than 0.30 $m^3$/second (10.6 $ft^3$/second). Instream flows probably increase slightly by the time it reaches Lily Grade (river mile 31) with downstream ground water influence. With the loss of the natural hydrologic cycle downstream of Salmon Falls Creek dam there is no longer stream bed scouring and flooding. Without water flowing directly from upper Salmon Falls Creek there is also no longer an influx of sands, fine sediments or gravels from upstream erosion. Many sites throughout the reach have numerous large boulders from the

inner canyon walls piled into the stream bed. Since there is no annual over bank flooding, the riparian zone is narrow with vegetation encroaching on the stream channel. Riparian shrub species include rose Rosa woodsii, coyote willow Salix exigue, red-osier dogwood Cornus stolonifera, golden currant Ribes aureum, poison ivy Toxicodendron radicans, and a few other species. Dominant herbaceous species include cattail Typha spp., reed Phragmites spp., Nebraska sedge Carex nebraskensis, beaked sedge Carex spp., spikerush Eleocharis spp., baltic rush Juncus bealticus, bulrush Scirpus spp., meadow foxtail Alopecurus pratensis, horsetail Equisetum spp., goldenrod Solidago spp., and mint Mentha spp.. Upland vegetation within the canyon is dominated by several grass species with big sagebrush Artemesia tridentata, and rabbitbrush Chrysothamnus spp. (J. Klott, BLM pers. comm.). There has been no grazing by livestock within this reach of the canyon since 1984.

The fishery in this reach of Salmon Falls Creek historically included anadromous chinook salmon Oncorhynchus tshawytscha, steelhead trout O. mykiss and other native species normally found below Shoshone Falls. Anadromous fish are known to have spawned and reared in the mainstem and tributaries of the Snake River up to Shoshone Falls until the construction of Swan Falls, Brownlee and Oxbow dams (Idaho Dept. Fish and Game 1992). Recent incidental fishing reports from Salmon Falls Creek indicate populations of wild rainbow/redband trout O. mykiss, introduced brook trout Salvelinus fontinalis and smallmouth bass Micropterus dolomieui. One angler reported last catching bull trout S. confluentus downstream of the Balanced Rock crossing as recently as the early 1960's. Hatchery reared rainbow trout O. mykiss are currently stocked at the Balanced Rock Park.

Prior to the construction of Salmon Falls Creek Dam, the hydrologic cycle of the lower Salmon Falls Creek system probably simulated todays cycle at the U.S.G.S. gaging station near San Jacinto, Nevada. In records published for the period between 1910 and 1993 (Harenberg, et al. 1993) the highest annual mean discharge at this site was 439 $ft^3$/second (cfs) in 1984 and the lowest annual mean discharge was 45 cfs in 1934. The highest daily mean discharge ever recorded was 3,620 cfs on May 16, 1984 and the lowest daily mean was 3.2 cfs on September 4, 1961.

## METHODS

A total of four sites between Lily Grade and Salmon Falls Creek dam were investigated for fish species composition and instream habitat (Figure 1). Fish were also sampled at the Balanced Rock Park (approximately river mile 16) within a 234 m long reach, but no habitat assessment was made there. Habitat and flows in this reach have been altered by road and park construction which backs water up in the channel for several

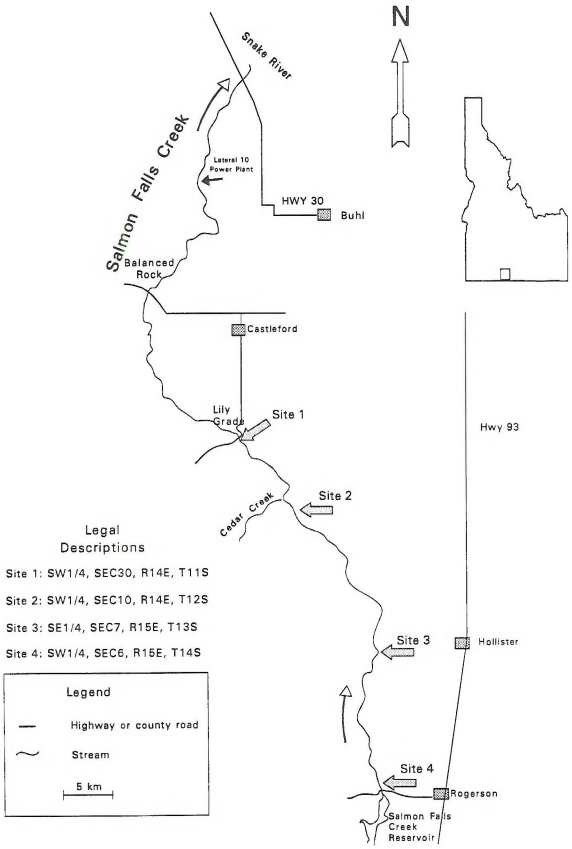


Figure 1. Map of Salmon Falls Creek depicting survey sites.

hundred meters. Total length of each site between Lily Grade and Salmon Falls Creek dam ranged from 98 to 190 m long. An effort was made to select sites which appeared to represent habitat types within the reach. Prior to the survey, a video tape was made of the entire stream from Balanced Rock to Salmon Falls Creek dam from fixed wing aircraft. The purpose of this was to identify possible fish barriers as well as access sites into the canyon.

Fish were sampled at each site by electrofishing with the sampling crew working their way upstream. At the Balanced Rock Park site a drift boat with a Coffelt VVP-15 Electrofisher powered with a Honda 5000 generator was used. Utilizing the boat hull as the cathode and two anodes suspended off the bow, two crew members acted as netters and one crew member rowed and controlled the electrical output. All fish stunned were netted and put into a live well in the boat. At the other four sites fish were sampled with a Smith-Root Model 15-A backpack shocker with two to three crew members working as netters and one additional crew member receiving netted fish into a bucket. Two passes were made at the four sites that the backpack shocker was used. All fish were identified, measured, and enumerated from each pass. Scale samples and weights were taken from some of the game fish species. A Seber LeCren (1967) two pass population estimate was made for game fish species. Fish population densities were estimated based on total surface area of site sampled and total population estimates. Length-at-age was estimated from scale samples at each site. Ten each of the brook and rainbow trout sampled from Site 4 were preserved on ice in the field then frozen and transported to the Fish and Game Fish Health Laboratory to be tested for Bacteria Kidney Disease (BKD) Renibacterium salmoninarum and whirling disease Myxosoma cerebralis. For BKD testing the 10 fish were pooled into 2 groups of 5 fish each. Tests were run utilizing the Enzyme Linked Immuno-Sorbant Assay (ELISA) and Flourescent Antibody Test (FAT) procedures.

Habitat assessments were made where possible utilizing Idaho Department of Fish and Game standardized stream survey procedures which are based on methods described by Platts et al. (1983) and Rosgen (1985). Four to ten transects were systematically selected for habitat measurements throughout each sample site. Features measured across transects include total stream width, total depth, water column habitat type and substrate class at one-fourth, one-half, and three-fourths the distance across the transect. Total stream discharge volume was measured at the Lily Grade site on August 4, 1994 using a Marsh-McBirney flow meter and methods described by Platts et al. (1983).

Water temperature profiles were measured at two sites on Salmon Falls Creek using continuously recording Ryan TempMentor thermographs. A thermograph was set approximately 20 m upstream

of the Lily Grade crossing within site one between the dates of May 14 and September 22, 1994 and a thermograph was set approximately 10 m upstream of the Lateral 10 power plant outflow between June 11 and October 17, 1994. Both thermographs were completely submerged within the main channel of the stream and set to record ambient water temperature every 30 minutes.

## RESULTS

Due to the nature of the steep narrow canyon and the side view from the fixed wing aircraft, portions of the stream channel between Lily Grade and Salmon Falls Dam were not covered on the video tape. However, the majority of the stream was observed. Large rock slides with boulders exceeding 3 meters across are common throughout the canyon and in many areas cover the entire stream channel. Although these slides have filled the canyon bottom, in most cases they are not barriers to fish movement. Inspection of some of these slides at sample sites found water flowing under and through the boulders which allowed fish to pass these slides. Not all slides were inspected and it is possible that a large slide area near site 3 may be an upstream barrier at current water flows. Additional barriers to fish movement in Salmon Falls Creek are seasonal dams located at several irrigation pump sites between Balanced Rock and the Snake River. Besides the dams, pumping during low water years can dewater short reaches of the stream during the summer.

Fish sampled in Salmon Falls Creek in 1994 included hatchery and wild rainbow trout, brook trout, smallmouth bass, largescale sucker Catostomus macrocheilus, bridgelip sucker C. columbianus, redside shiner Richardsonius balteatus, northern squawfish Ptychocheilus oregonensis, speckled dace Rhinichthys osculus, longnose dace R. cataractae, chiselmouth chub Acrocheilus alutaceus and mottled sculpin Cottus bairdi (Tables 1-5). Smallmouth bass were present up through site 2. Brook trout were only sampled in the upper two sites. Although wild rainbow trout were not sampled at Balanced Rock, they were found in all other sites. Wild rainbow trout were observed below Balanced Rock at Magic Water pump site in April, 1993 (Warren and Partridge, In Press). Nongame fish were sampled at all sites except site 4.

Fish sampling efforts at Balanced Rock park were not effective enough to collect a suitable sample for population estimates because of the excessive depth (> 2m) and dense aquatic vegetation. Population density estimates for wild rainbow trout ranged from 0.8 to 14.2/100$m^2$ at sites 1-4 (Table 6). Brook trout density estimates in sites 3 and 4 were 0.8 and 35.0/100$m^2$, respectively. Smallmouth bass density which was only estimated at site 1 due to sampling efficiency, was 2.6/100$m^2$. Population

Table 1. Fish sampled by electrofishing at the Balanced Rock site of Salmon Falls Creek with total length frequency in each 10 mm length group, percent of total, mean weight of hatchery rainbow trout and smallmouth bass, and total numbers of each species, collected July, 1994.

| | Hatchery rainbow trout | | | | Smallmouth bass | | | | Largescale sucker | | Redside shiner | | Northern squawfish | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length Range (mm) | Length | | Weight | | Length | | Weight | | Length | | Length | | Length | |
| | no. | % | no. | avg. | no. | % | no. | avg. | no. | % | no. | % | no. | % |
| 0-9 | | | | | | | | | | | | | | |
| 10-19 | | | | | | | | | | | | | | |
| 20-29 | | | | | | | | | | | | | | |
| 30-39 | | | | | | | | | | | | | | |
| 40-49 | | | | | | | | | | | | | | |
| 50-59 | | | | | | | | | | | | | | |
| 60-69 | | | | | | | | | | | | | | |
| 70-79 | | | | | | | | | | | | | | |
| 80-89 | | | | | | | | | | | 2 | 33.3 | | |
| 90-99 | | | | | | | | | | | 1 | 16.7 | | |
| 100-109 | | | | | | | | | | | 3 | 50.0 | | |
| 110-119 | | | | | | | | | | | | | | |
| 120-129 | | | | | 1 | 50.0 | 1 | 20 | | | | | | |
| 130-139 | | | | | | | | | | | | | | |
| 140-149 | | | | | | | | | | | | | | |
| 150-159 | | | | | | | | | | | | | | |
| 160-169 | | | | | | | | | | | | | | |
| 170-179 | | | | | | | | | | | | | | |
| 180-189 | | | | | | | | | | | | | | |
| 190-199 | | | | | | | | | | | | | | |
| 200-209 | | | | | | | | | | | | | | |
| 210-219 | | | | | 1 | 50.0 | 1 | 90 | | | | | | |
| 220-229 | | | | | | | | | | | | | 1 | 50.0 |
| 230-239 | 1 | 100.0 | 1 | 124 | | | | | | | | | | |
| 240-249 | | | | | | | | | | | | | 1 | 50.0 |
| 250-259 | | | | | | | | | | | | | | |
| 260-269 | | | | | | | | | | | | | | |
| 270-279 | | | | | | | | | | | | | | |
| 280-289 | | | | | | | | | | | | | | |
| 290-299 | | | | | | | | | | | | | | |
| 300-309 | | | | | | | | | | | | | | |
| 310-319 | | | | | | | | | | | | | | |
| 320-329 | | | | | | | | | | | | | | |
| 330-339 | | | | | | | | | | | | | | |
| 340-349 | | | | | | | | | | | | | | |
| 350-359 | | | | | | | | | | | | | | |
| 360-369 | | | | | | | | | | | | | | |
| 370-379 | | | | | | | | | | | | | | |
| 380-389 | | | | | | | | | | | | | | |
| 390-399 | | | | | | | | | | | | | | |
| 400-409 | | | | | | | | | | | | | | |
| 410-419 | | | | | | | | | | | | | | |
| 420-429 | | | | | | | | | | | | | | |
| 430-439 | | | | | | | | | | | | | | |
| 440-449 | | | | | | | | | | | | | | |
| 450-459 | | | | | | | | | | | | | | |
| 460-469 | | | | | | | | | 1 | 50.0 | | | | |
| 470-479 | | | | | | | | | | | | | | |
| 480-489 | | | | | | | | | | | | | | |
| 490-499 | | | | | | | | | | | | | | |
| 500-509 | | | | | | | | | 1 | 50.0 | | | | |
| 510-519 | | | | | | | | | | | | | | |
| 520-529 | | | | | | | | | | | | | | |
| 530-539 | | | | | | | | | | | | | | |
| 540-549 | | | | | | | | | | | | | | |
| Number: | 1 | | 1 | | 2 | | 2 | | 2 | | 6 | | 2 | |
| Avg. length: | 235 | | | | 165 | | | | 483 | | 96 | | 233 | |
| Total collected: | 1 | | 1 | | 2 | | 2 | | 2 | | 6 | | 2 | |

Table 2 . Fish sampled by electrofishing at site 1 of Salmon Falls Creek with total length frequency in each 10 mm length group, percent of total, mean weight of wild rainbow trout and smallmouth bass and total numbers of each species, collected July, 1994.

| Length Range (mm) | Wild rainbow trout | | | | Smallmouth bass | | | | Northern squawfish | | Speckled dace | | Mottled sculpin | | Bridgelip sucker | | Chiselmouth chub | | Longnose dace | | Largescale sucker | | Redside shiner | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length | | Weight | | Length | | Weight | | Length | | Length | | Length | | Length | | Length | | Length | | Length | | Length | |
| | no. | % | no. | avg. | no. | % | no. | avg. | no. | % | no. | % | no. | % | no. | % | no. | % | no. | % | no. | % | no. | % |
| 0-9 | | | | | | | | | | | | | | | | | | | | | | | | |
| 10-19 | | | | | | | | | | | | | | | | | | | | | | | | |
| 20-29 | | | | | | | | | | | | | | | | | | | | | | | | |
| 30-39 | | | | | | | | | | | | | 3 | 20.0 | | | | | | | | | | |
| 40-49 | | | | | | | | | | | | | | | | | | | | | | | | |
| 50-59 | 1 | 3.2 | | | | | | | | | | | | | | | | | | | | | 9 | 24.3 |
| 60-69 | | | | | | | | | | | | | 2 | 13.3 | | | | | | | | | | |
| 70-79 | 1 | 3.2 | | | | | | | | | | | 4 | 26.7 | | | | | | | | | 6 | 16.2 |
| 80-89 | 1 | 3.2 | | | 1 | 4.3 | 1 | 8 | | | | | 5 | 33.3 | | | | | | | | | 2 | 5.4 |
| 90-99 | 1 | 3.2 | | | 3 | 13.0 | 3 | 11 | | | | | | | | | | | | | | | | |
| 100-109 | | | | | | | | | | | | | 1 | 6.7 | | | | | | | | | 11 | 29.7 |
| 110-119 | | | | | 1 | 4.3 | 1 | 20 | 1 | 2.9 | 2 | 100.0 | | | 1 | 14.3 | | | 1 | 50.0 | 1 | 16.7 | 8 | 21.6 |
| 120-129 | 1 | 3.2 | 1 | 20 | | | | | 2 | 5.7 | | | | | 1 | 14.3 | | | 1 | 50.0 | 1 | 16.7 | 1 | 2.7 |
| 130-139 | | | | | | | | | 3 | 8.6 | | | | | | | 6 | 33.3 | | | 2 | 33.3 | | |
| 140-149 | 2 | 6.5 | 2 | 30 | | | | | 4 | 11.4 | | | | | | | 8 | 44.4 | | | 1 | 16.7 | | |
| 150-159 | 1 | 3.2 | 1 | 45 | 1 | 4.3 | 1 | 50 | 3 | 8.6 | | | | | | | 3 | 16.7 | | | | | | |
| 160-169 | | | | | 1 | 4.3 | 1 | 60 | | | | | | | | | | | | | | | | |
| 170-179 | 1 | 3.2 | 1 | 54 | 3 | 13.0 | 3 | 65 | 6 | 17.1 | | | | | 1 | 14.3 | 1 | 5.6 | | | | | | |
| 180-189 | 2 | 6.5 | | | 3 | 13.0 | 3 | 72 | 9 | 25.7 | | | | | 1 | 14.3 | | | | | | | | |
| 190-199 | 4 | 12.9 | 4 | 77 | 1 | 4.3 | 1 | 94 | 4 | 11.4 | | | | | 2 | 28.6 | | | | | 1 | 16.7 | | |
| 200-209 | 4 | 12.9 | 4 | 84 | 4 | 17.4 | 4 | 107 | 2 | 5.7 | | | | | | | | | | | | | | |
| 210-219 | 3 | 9.7 | 3 | 97 | 1 | 4.3 | 1 | 138 | 1 | 2.9 | | | | | | | | | | | | | | |
| 220-229 | 1 | 3.2 | 1 | 98 | | | | | | | | | | | | | | | | | | | | |
| 230-239 | 3 | 9.7 | 3 | 125 | 1 | 4.3 | 1 | 148 | | | | | | | | | | | | | | | | |
| 240-249 | | | | | 1 | 4.3 | 1 | 180 | | | | | | | 1 | 14.3 | | | | | | | | |
| 250-259 | 2 | 6.5 | 1 | 158 | | | | | | | | | | | | | | | | | | | | |
| 260-269 | | | | | 1 | 4.3 | 1 | 252 | | | | | | | | | | | | | | | | |
| 270-279 | 1 | 3.2 | 1 | 176 | 1 | 4.3 | 1 | 260 | | | | | | | | | | | | | | | | |
| 280-289 | | | | | | | | | | | | | | | | | | | | | | | | |
| 290-299 | | | | | | | | | | | | | | | | | | | | | | | | |
| 300-309 | 1 | 3.2 | 1 | 258 | | | | | | | | | | | | | | | | | | | | |
| 310-319 | | | | | | | | | | | | | | | | | | | | | | | | |
| 320-329 | | | | | | | | | | | | | | | | | | | | | | | | |
| 330-339 | | | | | | | | | | | | | | | | | | | | | | | | |
| 340-349 | 1 | 3.2 | 1 | 355 | | | | | | | | | | | | | | | | | | | | |
| 350-359 | | | | | | | | | | | | | | | | | | | | | | | | |
| 360-369 | | | | | | | | | | | | | | | | | | | | | | | | |
| 370-379 | | | | | | | | | | | | | | | | | | | | | | | | |
| 380-389 | | | | | | | | | | | | | | | | | | | | | | | | |
| 390-399 | | | | | | | | | | | | | | | | | | | | | | | | |
| Number: | 31 | | 24 | | 23 | | 23 | | 35 | | 2 | | 15 | | 7 | | 18 | | 2 | | 6 | | 37 | |
| Avg. length: | 192 | | | | 177 | | | | 166 | | 113 | | 68 | | 173 | | 143 | | 115 | | 138 | | 89 | |
| Total Collected: | 31 | | | | 23 | | | | 70 | | 2 | | 15 | | 7 | | 18 | | 2 | | 6 | | 179 | |

Table 3. Fish sampled by electrofishing at site 2 of Salmon Falls Creek with total length frequency in each 10 mm length group, percent of total, mean weight of wild rainbow trout and smallmouth bass and total numbers of each species, collected October, 1994.

| | Wild rainbow trout | | | | Smallmouth bass | | | | Bridgelip sucker | | Mottled sculpin | | Redside shiner | | Speckled dace | | Northern squawfish | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length Range | Length | | Weight | | Length | | Weight | | Length | | Length | | Length | | Length | | Length | |
| (mm) | no. | % | no. | avg. | no. | % | no. | avg. | no. | % | no. | % | no. | % | no. | % | no. | % |
| 0-9 | | | | | | | | | | | | | | | | | | |
| 10-19 | | | | | | | | | | | | | | | | | | |
| 20-29 | | | | | | | | | | | | | 6 | 50.0 | | | | |
| 30-39 | | | | | | | | | | | 1 | 7.7 | 5 | 41.7 | 2 | 66.7 | | |
| 40-49 | | | | | | | | | | | 3 | 23.1 | 1 | 8.3 | 1 | 33.3 | | |
| 50-59 | | | | | | | | | 1 | 12.5 | 4 | 30.8 | | | | | | |
| 60-69 | | | | | | | | | 1 | 12.5 | 1 | 7.7 | | | | | | |
| 70-79 | | | | | | | | | | | 3 | 23.1 | | | | | | |
| 80-89 | | | | | | | | | | | 1 | 7.7 | | | | | | |
| 90-99 | | | | | | | | | | | | | | | | | | |
| 100-109 | | | | | | | | | | | | | | | | | | |
| 110-119 | | | | | | | | | | | | | | | | | 1 | 11.1 |
| 120-129 | | | | | | | | | | | | | | | | | 1 | 11.1 |
| 130-139 | | | | | | | | | | | | | | | | | 2 | 22.2 |
| 140-149 | | | | | 2 | 14.3 | 2 | 37 | 1 | 12.5 | | | | | | | | |
| 150-159 | | | | | 2 | 14.3 | 2 | 45 | 2 | 25.0 | | | | | | | | |
| 160-169 | | | | | 1 | 7.1 | 1 | 59 | 2 | 25.0 | | | | | | | | |
| 170-179 | 1 | 11.1 | 1 | 56 | 4 | 28.6 | 4 | 63 | | | | | | | | | 2 | 22.2 |
| 180-189 | 1 | 11.1 | 1 | 54 | 1 | 7.1 | 1 | 84 | | | | | | | | | 3 | 33.3 |
| 190-199 | 1 | 11.1 | 1 | 66 | 1 | 7.1 | 1 | 86 | | | | | | | | | | |
| 200-209 | | | | | | | | | | | | | | | | | | |
| 210-219 | 3 | 33.3 | 3 | 84 | | | | | 1 | 12.5 | | | | | | | | |
| 220-229 | | | | | 1 | 7.1 | 1 | 142 | | | | | | | | | | |
| 230-239 | | | | | 1 | 7.1 | 1 | 164 | | | | | | | | | | |
| 240-249 | | | | | | | | | | | | | | | | | | |
| 250-259 | 1 | 11.1 | 1 | 142 | | | | | | | | | | | | | | |
| 260-269 | 2 | 22.2 | 2 | 180 | 1 | 7.1 | 1 | 216 | | | | | | | | | | |
| 270-279 | | | | | | | | | | | | | | | | | | |
| 280-289 | | | | | | | | | | | | | | | | | | |
| 290-299 | | | | | | | | | | | | | | | | | | |
| 300-309 | | | | | | | | | | | | | | | | | | |
| 310-319 | | | | | | | | | | | | | | | | | | |
| 320-329 | | | | | | | | | | | | | | | | | | |
| 330-339 | | | | | | | | | | | | | | | | | | |
| 340-349 | | | | | | | | | | | | | | | | | | |
| 350-359 | | | | | | | | | | | | | | | | | | |
| 360-369 | | | | | | | | | | | | | | | | | | |
| 370-379 | | | | | | | | | | | | | | | | | | |
| 380-389 | | | | | | | | | | | | | | | | | | |
| 390-399 | | | | | | | | | | | | | | | | | | |
| Number: | 9 | | 9 | | 14 | | 14 | | 8 | | 13 | | 12 | | 3 | | 9 | |
| Avg. Lgth: | 217 | | | | 181 | | | | 141 | | 65 | | 39 | | 43 | | 158 | |
| Total Collected | 9 | | | | 14 | | | | 8 | | 13 | | 12 | | 3 | | 9 | |

Table 4. Fish sampled by electrofishing at site 3 of Salmon Falls Creek with total length frequency in each 10 mm length group, percent of total, mean weight of wild rainbow trout and brook trout, and total numbers of each species, collected July, 1994.

| Length Range (mm) | Wild rainbow trout | | | | Brook trout | | | | Bridgelip sucker | | Chiselmouth chub | | Longnose dace | | Mottled sculpin | | Redside shiner | | Speckled dace | | Northern squawfish | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length | | Weight | | Length | | Weight | | Length | | Length | | Length | | Length | | Length | | Length | | Length | |
| | no. | % | no. | avg. | no. | % | no. | avg. | no. | % | no. | % | no. | % | no. | % | no. | % | no. | % | no. | % |
| 0-9 | | | | | | | | | | | | | | | | | | | | | | |
| 10-19 | | | | | | | | | | | | | | | | | 1 | 2.0 | | | | |
| 20-29 | | | | | | | | | | | | | 2 | 18.2 | 2 | 10.0 | 1 | 2.0 | | | | |
| 30-39 | | | | | | | | | | | | | | | 7 | 35.0 | 1 | 2.0 | | | | |
| 40-49 | 1 | 2.5 | | | | | | | 1 | 2.6 | | | 1 | 9.1 | 1 | 5.0 | | | | | | |
| 50-59 | 3 | 7.5 | | | | | | | | | | | 2 | 18.2 | 2 | 10.0 | 1 | 2.0 | 1 | 50 | | |
| 60-69 | 2 | 5.0 | | | | | | | | | | | 1 | 9.1 | 2 | 10.0 | 2 | 4.1 | | | | |
| 70-79 | 1 | 2.5 | | | 1 | 12.5 | | | | | | | 3 | 27.3 | 4 | 20.0 | 19 | 38.8 | | | | |
| 80-89 | 1 | 2.5 | | | 4 | 50.0 | 1 | 5 | | | | | 1 | 9.1 | 2 | 10.0 | 13 | 26.5 | 1 | 50 | | |
| 90-99 | | | | | 1 | 12.5 | | | | | | | 1 | 9.1 | | | 11 | 22.4 | | | | |
| 100-109 | | | | | 1 | 12.5 | 1 | 12 | 1 | 2.6 | | | | | | | | | | | | |
| 110-119 | | | | | | | | | 7 | 18.4 | 1 | 25.0 | | | | | | | | | 1 | 10.0 |
| 120-129 | | | | | | | | | 11 | 28.9 | 2 | 50.0 | | | | | | | | | 2 | 20.0 |
| 130-139 | | | | | | | | | 2 | 5.3 | 1 | 25.0 | | | | | | | | | 2 | 20.0 |
| 140-149 | | | | | | | | | 11 | 28.9 | | | | | | | | | | | 1 | 10.0 |
| 150-159 | 6 | 15.0 | 5 | 35 | | | | | 3 | 7.9 | | | | | | | | | | | | |
| 160-169 | 3 | 7.5 | 2 | 43 | 1 | 12.5 | 1 | 45 | 1 | 2.6 | | | | | | | | | | | 2 | 20.0 |
| 170-179 | 4 | 10.0 | 2 | 55 | | | | | | | | | | | | | | | | | 1 | 10.0 |
| 180-189 | 6 | 15.0 | 2 | 57 | | | | | 1 | 2.6 | | | | | | | | | | | 1 | 10.0 |
| 190-199 | 9 | 22.5 | 4 | 74 | | | | | | | | | | | | | | | | | | |
| 200-209 | 1 | 2.5 | 1 | 78 | | | | | | | | | | | | | | | | | | |
| 210-219 | 2 | 5.0 | 2 | 92 | | | | | | | | | | | | | | | | | | |
| 220-229 | | | | | | | | | | | | | | | | | | | | | | |
| 230-239 | | | | | | | | | | | | | | | | | | | | | | |
| 240-249 | | | | | | | | | | | | | | | | | | | | | | |
| 250-259 | 1 | 2.5 | 1 | 138 | | | | | | | | | | | | | | | | | | |
| 260-269 | | | | | | | | | | | | | | | | | | | | | | |
| 270-279 | | | | | | | | | | | | | | | | | | | | | | |
| 280-289 | | | | | | | | | | | | | | | | | | | | | | |
| 290-299 | | | | | | | | | | | | | | | | | | | | | | |
| 300-309 | | | | | | | | | | | | | | | | | | | | | | |
| 310-319 | | | | | | | | | | | | | | | | | | | | | | |
| 320-329 | | | | | | | | | | | | | | | | | | | | | | |
| 330-339 | | | | | | | | | | | | | | | | | | | | | | |
| 340-349 | | | | | | | | | | | | | | | | | | | | | | |
| 350-359 | | | | | | | | | | | | | | | | | | | | | | |
| 360-369 | | | | | | | | | | | | | | | | | | | | | | |
| 370-379 | | | | | | | | | | | | | | | | | | | | | | |
| 380-389 | | | | | | | | | | | | | | | | | | | | | | |
| 390-399 | | | | | | | | | | | | | | | | | | | | | | |
| Number: | 40 | | 40 | | 8 | | 8 | | 38 | | 4 | | 11 | | 20 | | 49 | | 2 | | 10 | |
| Avg length: | 157 | | | | 96 | | | | 129 | | 125 | | 68 | | 60 | | 85 | | 75 | | 155 | |
| Total Collected | 40 | | | | 8 | | | | 38 | | 4 | | 11 | | 20 | | 49 | | 2 | | 10 | |



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Table 5. Fish sampled by electrofishing at site 4 of Salmon Falls Creek with total length frequency in each 10 mm length group, percent of total, mean weight of fish sampled, and total numbers of each species sampled, August, 1994.

| | Wild rainbow trout | | | | Brook trout | | | |
|---|---|---|---|---|---|---|---|---|
| Length Range (mm) | Length | | Weight | | Length | | Weight | |
| | no. | % | no. | avg. | no. | % | no. | avg. |
| 0–9 | | | | | | | | |
| 10–19 | | | | | | | | |
| 20–29 | | | | | | | | |
| 30–39 | | | | | | | | |
| 40–49 | 1 | 2.0 | | | | | | |
| 50–59 | 1 | 2.0 | | | | | | |
| 60–69 | | | | | 3 | 1.8 | | |
| 70–79 | | | | | 14 | 8.3 | | |
| 80–89 | | | | | 18 | 10.7 | 1 | 4 |
| 90–99 | | | | | 21 | 12.4 | | |
| 100–109 | | | | | 27 | 16.0 | 4 | 13 |
| 110–119 | 1 | 2.0 | 1 | 18 | 15 | 8.9 | 3 | 15 |
| 120–129 | | | | | 1 | 0.6 | | |
| 130–139 | 3 | 6.0 | 2 | 22 | 1 | 0.6 | | |
| 140–149 | 1 | 2.0 | | | 1 | 0.6 | | |
| 150–159 | 3 | 6.0 | 2 | 41 | 1 | 0.6 | | |
| 160–169 | 4 | 8.0 | 1 | 36 | | | | |
| 170–179 | 5 | 10.0 | 2 | 56 | | | | |
| 180–189 | 6 | 12.0 | 3 | 60 | 1 | 0.6 | | |
| 190–199 | 3 | 6.0 | 1 | 92 | 13 | 7.7 | 1 | 84 |
| 200–209 | 2 | 4.0 | | | 11 | 6.5 | 3 | 99 |
| 210–219 | 4 | 8.0 | 2 | 112 | 15 | 8.9 | 3 | 117 |
| 220–229 | 4 | 8.0 | 2 | 113 | 10 | 5.9 | | |
| 230–239 | 1 | 2.0 | | | 8 | 4.7 | 2 | 142 |
| 240–249 | 3 | 6.0 | 1 | 140 | 6 | 3.6 | 2 | 175 |
| 250–259 | 2 | 4.0 | 1 | 162 | 2 | 1.2 | 2 | 198 |
| 260–269 | 1 | 2.0 | | | 1 | 0.6 | | |
| 270–279 | 4 | 8.0 | 4 | 205 | | | | |
| 280–289 | | | | | | | | |
| 290–299 | | | | | | | | |
| 300–309 | | | | | | | | |
| 310–319 | | | | | | | | |
| 320–329 | | | | | | | | |
| 330–339 | | | | | | | | |
| 340–349 | | | | | | | | |
| 350–359 | | | | | | | | |
| 360–369 | | | | | | | | |
| 370–379 | 1 | 2.0 | 1 | 500 | | | | |
| 380–389 | | | | | | | | |
| 390–399 | | | | | | | | |
| Number: | 50 | | 23 | | 169 | | 21 | |
| Avg. length: | 194 | | | | 141 | | | |
| Total Collected: | 50 | | | | 169 | | | |

Table 6. Salmon Falls Creek game fish population estimates, standard errors, and densities for sites electrofished.

| | Site | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Date | 7/13/94 | 10/18/94 | 8/16/94 | 8/22/94 |
| Wild rainbow trout | | | | |
| Population estimate | 32 | 12 | 88 | 131 |
| Standard error | 1.03 | 6.00 | 68.69 | 120.99 |
| Density (no./100 $m^2$) | 3.2 | 0.82 | 7.88 | 14.2 |
| Brook trout | | | | |
| Population estimate | - | - | 8 | 322 |
| Standard error | | | -[a] | 93.34 |
| Density (no./100 $m^2$) | | | 0.82 | 35.04 |
| Smallmouth bass | | | | |
| Population estimate | 25 | -[b] | - | - |
| Standard error | 2.55 | | | |
| Density (no./100 $m^2$) | 2.57 | | | |

[a] Standard error of population estimate of brook trout at site 3 not calculable with second removal pass catch equal to 0.
[b] Both first and second removal pass catches were equal to 7 smallmouth each at site 2.

estimates were not made on nongame fish due to sampling inefficiencies on small fish.

Length-at-age estimates for some of the game fish sampled are given in Tables 7 and 8. There is no length-at-age estimate table for wild rainbow trout from site 1 or brook trout from sites 3 or 4 because only age $0^+$ and $1^+$ fish were sampled from these sites. Mean back calculated length to age 1 for 15 rainbow trout sampled from the 1993 year class at site one was 145 mm with a standard deviation of 33.59. Mean back calculated length to age 1 for 5 brook trout sampled from the 1993 year class at site 4 was 134 mm with a standard deviation of 26.48. Of scale samples taken from brook trout at site 3, only one was age $1^+$ and the rest were age $0^+$.

Fish health laboratory test results for BKD were positive-low utilizing the ELISA procedure and negative utilizing the FAT procedure on both rainbow and brook trout. Whirling disease samples were negative for brook trout but presumptive positive for rainbow trout. The presumptive positive designation was given since Myxobolus sp. spores were found by digestion method although no M. cerebralis were confirmed present in histological samples. Also, whirling disease positive fish were stocked into Salmon Falls Creek in Nevada upstream of Salmon Falls Creek Reservoir in the 1980's.

Instream substrate consisted mainly of fines (sand and organic silt) and boulder. These two groups accounted for 85 to 95 percent of the substrate in sites 1-4 (Table 9). The highest gradient measured was within site 4 which was 5% over the entire 98 m reach. Due to the areas of boulders, the stream gradient is a stair step system of flat pool/run areas above boulder areas with steeper gradients. Stream channel type for all sites surveyed was confined. Total stream discharge as measured at Lily Grade on August 4, 1994 was 11.87 cfs. Maximum water temperature at Lily Grade between May 14 and September 22, 1994 was 25.8 C (Table 10). Above the Lateral 10 hydro inflow between June 11 and October 17, 1994, it was 22.2 C. Daily average water temperatures averaged 1.6 C warmer at Lily Grade than downstream near Lateral 10 hydro, with a maximum difference of 3 C on August 6, 1994.

## DISCUSSION

The Salmon Falls Creek fishery indicates that water quality is relatively good within the reach between Salmon Falls Creek Dam and Lily Grade. Instream and riparian habitat conditions, however, have been significantly altered by the decrease in stream flows from the diversion of water at Salmon Falls Creek Dam. Within this reach there exists a gradient in fish community

Table 7. Back calculated length-at-age (mm) for smallmouth bass sampled from Salmon Falls Creek. Standard deviation is in parenthesis.

Site 1, July 13, 1994

| Year class | Number of fish | Mean length at annulus 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1993 | 3 | 62 (0.96) | | | |
| 1992 | 9 | 88 (7.33) | 148 (17.70) | | |
| 1991 | 2 | 82 (8.08) | 153 (19.62) | 218 (17.25) | |
| 1990 | 1 | 65 (-) | 102 (-) | 153 (-) | 193 (-) |
| Weighted average length | | 80 | 145 | 196 | 193 |

Site 2, October 18, 1994

| Year class | Number of fish | Mean length at annulus 1 | 2 | 3 |
|---|---|---|---|---|
| 1993 | 7 | 105 (12.23) | | |
| 1992 | 9 | 72 (2.33) | 117 (6.51) | |
| 1991 | 2 | 81 (18.47) | 142 (6.22) | 199 (7.16) |
| Weighted average length | | 91 | 125 | 199 |

Table 8. Back calculated length-at-age (mm) for wild rainbow trout sampled from Salmon Falls Creek. Standard deviation is in parenthesis.

Site 2, October 18, 1994

| Year class | Number of fish | Mean length at annulus 1 | 2 |
|---|---|---|---|
| 1993 | 5 | 117 (15.83) | |
| 1992 | 4 | 124 (35.68) | 171 (89.75) |
| Weighted average length | | 120 | 171 |

Site 3, August 16, 1994

| Year class | Number of fish | Mean length at annulus 1 | 2 | 3 |
|---|---|---|---|---|
| 1993 | 17 | 128 (14.74) | | |
| 1992 | (none sampled) | - | - | |
| 1991 | 1 | 114 (-) | 168 (-) | 223 (-) |
| Weighted average length | | 127 | 168 | 223 |

Table 8. Continued.

Site 4, August 22, 1994

| Year class | Number of fish | Mean length at annulus 1 | 2 | 3 |
|---|---|---|---|---|
| 1993 | 14 | 98 (16.71) | | |
| 1992 | 6 | 110 (17.02) | 199 (26.56) | |
| 1991 | 1 | 129 (-) | 220 (-) | 297 (-) |
| Weighted average length | | 103 | 202 | 297 |

Table 9. Habitat data collected from all sites surveyed in the Salmon Falls Creek drainage, 1994.

| | Site | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Reach length (m) | 190.6 | 150.0 | 147.0 | 97.8 |
| Mean width (m) | 5.1 | 9.7 | 7.6 | 9.4 |
| Mean depth (cm) | 49.1 | 20.8 | 36.4 | 43.5 |
| Habitat (%) | | | | |
| Pool | 43.3 | 0.0 | 67.0 | 80.0 |
| Run | 43.3 | 29.0 | 8.0 | 0.0 |
| Pocket | 3.3 | 25.0 | 0.0 | 0.0 |
| Riffle | 6.7 | 8.0 | 25.0 | 20.0 |
| Backwater | 3.3 | 21.0 | 0.0 | 0.0 |
| Dry | 0.0 | 17.0[a] | 0.0 | 0.0 |
| Substrate Class (%) | | | | |
| Sand | 41.0 | 50.0 | 54.6 | 22.3 |
| Gravel | 6.7 | 3.8 | 4.6 | 4.0 |
| Rubble | 8.3 | 0.4 | 0.0 | 5.0 |
| Boulder | 44.0 | 45.8 | 40.8 | 68.7 |
| Bedrock | 0.0 | 0.0 | 0.0 | 0.0 |

[a] Exposed rock outcroppings.

Table 10. Daily minimum, maximum and average water temperatures (Celcius) recorded at Lily Grade and immediately upstream of the Lateral 10 hydropower outflow.

| | Salmon Falls Creek at Lily Grade<br>May 14 - Sept. 22, 1994 | | | Salmon Falls Creek upstream of Lateral 10 hydropower outflow<br>June 11 - Oct. 17, 1994 | | |
|---|---|---|---|---|---|---|
| | MAXIMUM 25.8<br>MINIMUM 10.3<br>AVERAGE 18.9 | | | MAXIMUM 24.0<br>MINIMUM 13.0<br>AVERAGE 18.2 | | |
| DATE | MAXIMUM | MINIMUM | AVERAGE | MAXIMUM | MINIMUM | AVERAGE |
| 14-May-94 | 18.2 | 13.3 | 15.9 | | | |
| 15-May-94 | 16.9 | 15.0 | 15.8 | | | |
| 16-May-94 | 14.8 | 13.1 | 13.9 | | | |
| 17-May-94 | 14.1 | 11.5 | 12.8 | | | |
| 18-May-94 | 13.6 | 11.4 | 12.5 | | | |
| 19-May-94 | 13.1 | 10.9 | 12.2 | | | |
| 20-May-94 | 13.2 | 10.7 | 12.0 | | | |
| 21-May-94 | 16.5 | 10.3 | 13.4 | | | |
| 22-May-94 | 18.4 | 12.3 | 15.3 | | | |
| 23-May-94 | 20.2 | 13.9 | 17.0 | | | |
| 24-May-94 | 21.1 | 15.0 | 18.1 | | | |
| 25-May-94 | 21.8 | 15.6 | 18.7 | | | |
| 26-May-94 | 21.9 | 16.5 | 19.4 | | | |
| 27-May-94 | 19.6 | 17.2 | 18.4 | | | |
| 28-May-94 | 18.7 | 15.0 | 17.0 | | | |
| 29-May-94 | 20.2 | 15.1 | 17.6 | | | |
| 30-May-94 | 21.1 | 15.2 | 18.3 | | | |
| 31-May-94 | 19.3 | 16.2 | 17.2 | | | |
| 01-Jun-94 | 19.3 | 14.8 | 16.6 | | | |
| 02-Jun-94 | 20.3 | 14.4 | 17.5 | | | |
| 03-Jun-94 | 21.5 | 16.8 | 19.1 | | | |

| DATE | MAXIMUM | MINIMUM | AVERAGE | MAXIMUM | MINIMUM | AVERAGE |
|---|---|---|---|---|---|---|
| 04-Jun-94 | 21.4 | 16.2 | 19.0 | | | |
| 05-Jun-94 | 22.4 | 16.5 | 19.5 | | | |
| 06-Jun-94 | 20.4 | 16.2 | 18.1 | | | |
| 07-Jun-94 | 16.5 | 13.1 | 15.0 | | | |
| 08-Jun-94 | 18.3 | 12.3 | 15.3 | | | |
| 09-Jun-94 | 19.9 | 13.7 | 16.8 | | | |
| 10-Jun-94 | 21.1 | 14.8 | 18.0 | | | |
| 11-Jun-94 | 21.4 | 16.5 | 19.2 | 21.3 | 15.3 | 18.3 |
| 12-Jun-94 | 22.0 | 18.0 | 20.1 | 20.7 | 16.5 | 18.7 |
| 13-Jun-94 | 20.9 | 17.8 | 19.3 | 19.1 | 15.7 | 17.7 |
| 14-Jun-94 | 18.9 | 14.4 | 16.7 | 18.8 | 13.2 | 15.7 |
| 15-Jun-94 | 18.7 | 13.3 | 16.1 | 19.1 | 13.1 | 15.5 |
| 16-Jun-94 | 18.0 | 13.4 | 15.8 | 18.3 | 13.0 | 15.4 |
| 17-Jun-94 | 19.3 | 13.3 | 16.4 | 19.6 | 13.0 | 16.1 |
| 18-Jun-94 | 21.0 | 15.3 | 18.1 | 20.8 | 14.3 | 17.3 |
| 19-Jun-94 | 22.0 | 16.2 | 19.1 | 21.6 | 15.0 | 17.9 |
| 20-Jun-94 | 22.8 | 17.4 | 20.2 | 22.2 | 15.8 | 18.6 |
| 21-Jun-94 | 22.0 | 18.6 | 20.5 | 20.6 | 16.7 | 18.6 |
| 22-Jun-94 | 22.8 | 18.2 | 20.6 | 22.0 | 16.5 | 18.9 |
| 23-Jun-94 | 23.6 | 18.0 | 20.8 | 22.5 | 16.2 | 19.0 |
| 24-Jun-94 | 23.2 | 17.8 | 20.6 | 21.8 | 15.7 | 18.5 |
| 25-Jun-94 | 24.1 | 18.3 | 21.3 | 22.8 | 15.9 | 19.0 |
| 26-Jun-94 | 22.3 | 18.8 | 20.8 | 20.6 | 15.9 | 18.0 |
| 27-Jun-94 | 21.0 | 16.4 | 19.0 | 20.0 | 14.1 | 17.1 |
| 28-Jun-94 | 22.6 | 17.1 | 19.9 | 22.0 | 15.3 | 18.5 |
| 29-Jun-94 | 24.0 | 18.9 | 21.3 | 22.5 | 16.6 | 19.3 |
| 30-Jun-94 | 23.6 | 19.0 | 21.4 | 22.6 | 16.3 | 19.2 |
| 01-Jul-94 | 24.1 | 18.7 | 21.5 | 23.0 | 16.2 | 19.2 |
| 02-Jul-94 | 22.1 | 19.1 | 20.8 | 21.3 | 16.6 | 18.7 |

Table 13. Continued.

| DATE | MAXIMUM | MINIMUM | AVERAGE | MAXIMUM | MINIMUM | AVERAGE |
|---|---|---|---|---|---|---|
| 03-Jul-94 | 21.4 | 17.3 | 19.4 | 20.0 | 14.8 | 17.3 |
| 04-Jul-94 | 20.8 | 16.0 | 18.4 | 20.0 | 14.1 | 16.8 |
| 05-Jul-94 | 19.5 | 16.9 | 18.1 | 18.2 | 15.2 | 16.6 |
| 06-Jul-94 | 18.5 | 15.0 | 16.6 | 19.1 | 13.6 | 16.0 |
| 07-Jul-94 | 21.2 | 15.3 | 18.1 | 21.2 | 14.6 | 17.8 |
| 08-Jul-94 | 22.8 | 17.1 | 19.9 | 22.1 | 15.7 | 18.9 |
| 09-Jul-94 | 22.0 | 18.4 | 20.5 | 21.6 | 16.4 | 19.0 |
| 10-Jul-94 | 22.6 | 18.3 | 20.2 | 21.4 | 16.3 | 18.5 |
| 11-Jul-94 | 22.3 | 17.0 | 19.7 | 20.9 | 14.7 | 17.7 |
| 12-Jul-94 | 22.4 | 17.1 | 19.7 | 21.4 | 15.0 | 17.8 |
| 13-Jul-94 | 22.8 | 17.5 | 20.1 | 21.2 | 15.3 | 18.1 |
| 14-Jul-94 | 23.2 | 18.1 | 20.6 | 21.9 | 15.8 | 18.6 |
| 15-Jul-94 | 23.7 | 18.3 | 21.0 | 22.5 | 15.9 | 19.0 |
| 16-Jul-94 | 24.1 | 19.5 | 21.8 | 22.4 | 16.4 | 19.3 |
| 17-Jul-94 | 24.9 | 20.2 | 22.5 | 22.6 | 17.1 | 19.8 |
| 18-Jul-94 | 24.5 | 20.2 | 22.3 | 22.4 | 17.1 | 19.7 |
| 19-Jul-94 | 23.5 | 19.4 | 21.5 | 21.6 | 15.9 | 18.8 |
| 20-Jul-94 | 23.8 | 18.6 | 21.2 | 22.3 | 15.8 | 19.0 |
| 21-Jul-94 | 24.3 | 19.4 | 21.8 | 23.4 | 16.5 | 19.9 |
| 22-Jul-94 | 24.1 | 20.2 | 22.2 | 23.4 | 17.0 | 20.1 |
| 23-Jul-94 | 23.3 | 20.8 | 22.1 | 22.1 | 18.5 | 20.0 |
| 24-Jul-94 | 24.0 | 19.6 | 21.8 | 22.7 | 17.1 | 19.8 |
| 25-Jul-94 | 25.3 | 20.5 | 22.8 | 23.8 | 17.4 | 20.5 |
| 26-Jul-94 | 25.8 | 21.1 | 23.4 | 23.9 | 18.0 | 20.8 |
| 27-Jul-94 | 25.1 | 21.7 | 23.4 | 24.0 | 18.6 | 20.9 |
| 28-Jul-94 | 24.6 | 21.1 | 22.7 | 23.5 | 18.0 | 20.5 |
| 29-Jul-94 | 23.0 | 20.4 | 21.8 | 22.0 | 17.4 | 19.8 |
| 30-Jul-94 | 23.5 | 20.8 | 22.0 | 22.0 | 18.0 | 19.9 |

Table 13. Continued.

| DATE | MAXIMUM | MINIMUM | AVERAGE | MAXIMUM | MINIMUM | AVERAGE |
|---|---|---|---|---|---|---|
| 31-Jul-94 | 23.5 | 20.4 | 21.9 | 22.6 | 17.6 | 20.0 |
| 01-Aug-94 | 23.3 | 20.1 | 21.7 | 22.6 | 17.6 | 20.0 |
| 02-Aug-94 | 23.1 | 19.6 | 21.4 | 23.0 | 17.1 | 19.9 |
| 03-Aug-94 | 24.2 | 19.3 | 21.7 | 22.8 | 17.0 | 20.0 |
| 04-Aug-94 | 25.3 | 20.5 | 22.8 | 23.1 | 17.0 | 20.1 |
| 05-Aug-94 | 25.6 | 21.0 | 23.2 | 23.2 | 17.4 | 20.2 |
| 06-Aug-94 | 24.6 | 20.4 | 22.4 | 22.3 | 16.5 | 19.4 |
| 07-Aug-94 | 24.4 | 19.9 | 22.2 | 22.4 | 16.3 | 19.4 |
| 08-Aug-94 | 22.5 | 20.8 | 21.7 | 20.7 | 17.2 | 19.0 |
| 09-Aug-94 | 23.2 | 19.1 | 21.1 | 21.4 | 16.2 | 18.7 |
| 10-Aug-94 | 21.8 | 20.0 | 21.0 | 20.2 | 17.1 | 18.7 |
| 11-Aug-94 | 23.3 | 19.1 | 21.2 | 22.2 | 16.4 | 19.1 |
| 12-Aug-94 | 23.6 | 20.1 | 21.8 | 21.2 | 17.3 | 19.4 |
| 13-Aug-94 | 24.1 | 20.2 | 22.1 | 22.4 | 16.8 | 19.6 |
| 14-Aug-94 | 24.3 | 20.3 | 22.2 | 22.3 | 16.8 | 19.8 |
| 15-Aug-94 | 23.9 | 20.2 | 22.0 | 21.6 | 16.8 | 19.4 |
| 16-Aug-94 | 23.2 | 19.1 | 21.1 | 20.8 | 15.8 | 18.4 |
| 17-Aug-94 | 22.6 | 18.4 | 20.5 | 20.9 | 15.5 | 18.2 |
| 18-Aug-94 | 22.6 | 18.7 | 20.6 | 21.0 | 15.6 | 18.4 |
| 19-Aug-94 | 22.3 | 18.9 | 20.5 | 20.5 | 15.6 | 18.2 |
| 20-Aug-94 | 22.1 | 19.0 | 20.5 | 20.7 | 15.9 | 18.5 |
| 21-Aug-94 | 22.6 | 19.5 | 21.0 | 21.2 | 16.4 | 18.8 |
| 22-Aug-94 | 21.3 | 18.5 | 20.0 | 19.3 | 15.3 | 17.5 |
| 23-Aug-94 | 20.7 | 16.8 | 18.8 | 19.6 | 14.3 | 17.0 |
| 24-Aug-94 | 21.3 | 17.4 | 19.3 | 19.9 | 14.7 | 17.4 |
| 25-Aug-94 | 21.3 | 17.5 | 19.4 | 20.1 | 15.0 | 17.6 |
| 26-Aug-94 | 20.8 | 17.6 | 19.3 | 19.9 | 14.8 | 17.5 |
| 27-Aug-94 | 20.4 | 17.5 | 18.9 | 19.4 | 15.3 | 17.4 |

Table 13. Continued.

| DATE | MAXIMUM | MINIMUM | AVERAGE | MAXIMUM | MINIMUM | AVERAGE |
|---|---|---|---|---|---|---|
| 28-Aug-94 | 21.3 | 17.7 | 19.5 | 20.3 | 15.6 | 17.9 |
| 29-Aug-94 | 20.4 | 17.7 | 19.1 | 19.2 | 15.2 | 17.2 |
| 30-Aug-94 | 19.3 | 16.2 | 17.8 | 18.2 | 14.1 | 16.2 |
| 31-Aug-94 | 19.3 | 15.5 | 17.4 | 18.7 | 13.7 | 16.3 |
| 01-Sep-94 | 19.5 | 16.0 | 17.7 | 19.0 | 14.2 | 16.6 |
| 02-Sep-94 | 19.0 | 16.1 | 17.6 | 18.6 | 14.5 | 16.6 |
| 03-Sep-94 | 19.3 | 16.1 | 17.7 | 18.7 | 14.8 | 16.7 |
| 04-Sep-94 | 18.6 | 15.6 | 17.1 | 18.1 | 14.1 | 16.0 |
| 05-Sep-94 | 18.4 | 14.7 | 16.6 | 18.1 | 13.2 | 15.7 |
| 06-Sep-94 | 19.3 | 15.3 | 17.2 | 18.9 | 14.0 | 16.3 |
| 07-Sep-94 | 19.9 | 16.5 | 18.1 | 19.2 | 14.9 | 17.0 |
| 08-Sep-94 | 20.2 | 16.9 | 18.5 | 19.2 | 15.0 | 17.1 |
| 09-Sep-94 | 19.2 | 16.5 | 17.9 | 18.1 | 14.4 | 16.2 |
| 10-Sep-94 | 17.7 | 14.8 | 16.3 | 17.4 | 13.4 | 15.3 |
| 11-Sep-94 | 16.8 | 14.1 | 15.5 | 16.8 | 13.2 | 15.0 |
| 12-Sep-94 | 15.7 | 13.9 | 14.9 | 16.3 | 13.4 | 14.8 |
| 13-Sep-94 | 16.0 | 13.6 | 14.8 | 16.6 | 13.5 | 14.9 |
| 14-Sep-94 | 15.7 | 13.6 | 14.6 | 16.8 | 13.4 | 14.8 |
| 15-Sep-94 | 16.4 | 13.2 | 14.8 | 17.1 | 13.3 | 15.0 |
| 16-Sep-94 | 16.8 | 13.4 | 15.0 | 17.4 | 13.3 | 15.3 |
| 17-Sep-94 | 17.1 | 14.0 | 15.6 | 17.6 | 13.6 | 15.5 |
| 18-Sep-94 | 18.0 | 14.4 | 16.1 | 17.6 | 14.1 | 15.7 |
| 19-Sep-94 | 17.9 | 14.7 | 16.2 | 17.9 | 13.9 | 15.8 |
| 20-Sep-94 | 17.6 | 14.7 | 16.1 | 17.6 | 14.1 | 15.7 |
| 21-Sep-94 | 17.2 | 14.6 | 15.9 | 17.4 | 13.9 | 15.6 |
| 22-Sep-94 | 16.8 | 13.7 | 15.1 | 17.4 | 13.6 | 15.3 |
| 23-Sep-94 | | | | 17.4 | 13.3 | 15.2 |
| 24-Sep-94 | | | | 17.3 | 13.2 | 15.1 |

Table 13. Continued.

| DATE | MAXIMUM | MINIMUM | AVERAGE | MAXIMUM | MINIMUM | AVERAGE |
|---|---|---|---|---|---|---|
| 25-Sep-94 | | | | 17.2 | 13.2 | 15.1 |
| 26-Sep-94 | | | | 16.8 | 13.4 | 15.0 |
| 27-Sep-94 | | | | 16.8 | 13.4 | 14.9 |
| 28-Sep-94 | | | | 16.8 | 13.3 | 15.1 |
| 29-Sep-94 | | | | 15.7 | 14.9 | 15.3 |
| 30-Sep-94 | | | | 15.0 | 14.5 | 14.7 |
| 01-Oct-94 | | | | 16.8 | 14.2 | 15.3 |
| 02-Oct-94 | | | | 15.8 | 13.1 | 14.6 |
| 03-Oct-94 | | | | 13.1 | 11.8 | 12.5 |
| 04-Oct-94 | | | | 12.8 | 11.1 | 11.9 |
| 05-Oct-94 | | | | 13.7 | 12.1 | 12.9 |
| 06-Oct-94 | | | | 13.4 | 11.6 | 12.6 |
| 07-Oct-94 | | | | 13.4 | 11.4 | 12.4 |
| 08-Oct-94 | | | | 13.7 | 11.1 | 12.4 |
| 09-Oct-94 | | | | 14.3 | 11.6 | 12.9 |
| 10-Oct-94 | | | | 14.3 | 12.1 | 13.2 |
| 11-Oct-94 | | | | 14.6 | 12.4 | 13.4 |
| 12-Oct-94 | | | | 13.6 | 11.8 | 12.8 |
| 13-Oct-94 | | | | 13.1 | 12.1 | 12.6 |
| 14-Oct-94 | | | | 12.4 | 11.0 | 11.7 |
| 15-Oct-94 | | | | 11.1 | 9.5 | 10.4 |
| 16-Oct-94 | | | | 11.6 | 10.0 | 10.7 |
| 17-Oct-94 | | | | 12.1 | 10.4 | 11.3 |

types ranging from a cool water fish community with significant numbers of smallmouth bass at the Lily Grade site to a cold water fish community dominated by brook trout at the dam site.

Habitat and water temperature conditions at the Lily Grade site are well within the range of conditions required for smallmouth bass survival and reproduction. Carlander (1977) cites numerous sources stating that smallmouth bass egg laying begins when rising water temperatures reach 13° - 15°C. This temperature had already been reached at site 1 by the time the thermograph was put in on May 14, 1994. Substrate requirements for smallmouth bass egg laying varies enough to probably not be a significant limiting factor to the species within this reach. The absence of smallmouth bass upstream of site 2 can only be speculated on. There is either a natural fish barrier possibly in the form of cascades or flow becomes subterraneal through rock slides, or water temperatures are modified enough from spring flows to favor only cold water fish species. Most likely it is a function of both since the aerial video tape does reveal narrow sections of the canyon with enough rocks in the bottom to obscure the stream course. If smallmouth bass are capable of migrating upstream, growth and reproduction may be limited by the cooler water temperatures.

Cooler downstream water temperatures just above Lateral 10 hydro are probably the result of significant spring inflows that occur along canyon walls below Lily Grade. Warmer temperatures in the Lily Grade area are a result of relatively low flows and the radiator effect of large black boulders in the stream channel. Water temperatures in sites 3 and 4 were not monitored, but the numerous brook trout indicate that temperatures are probably not excessively high. Temperatures are probably cooler and more stable as you approach the dam since water sources come mainly through the rock strata.

The high variability in densities of trout among sites indicates that the population may be limited by natural recruitment from younger year classes. Considering the lack of clean gravel at most sites, wild rainbow trout recruitment may be limited by a lack of successful spawning habitat. Although there is no significant influx of sediments from upstream sources, the modified flows below the dam no longer flush out silt from the areas of low velocity. Fine materials continue to enter the stream along the canyon due to natural erosion levels. As a result many of the pools and shoreline areas are laden with a deep layer of silt favoring the encroachment of shoreline vegetation. Since there is also no annual flooding there are few willows and cottonwoods thus very little instream woody debris. Most of the instream cover is provided by large boulders from the canyon walls.

Two fish species of special concern, bull trout and leatherside chub Gila copei that might of been in Salmon Falls Creek were not found. High water temperatures, lost of migration due to Salmon Falls Dam and brook trout introductions may have all played a part in the loss of bull trout from this portion of the drainage. Brook trout and altered flows may be the reason nongame fish were not found at site 4. Leatherside chub may never have been in the drainage but have been documented further up the Snake River drainage (Simpson and Wallace 1978).

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